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# TRANSPARENT CELLOPHANE COCOONING UNITS FOR OBSERVING THE DEVELOPMENT OF CODLING MOTH PUPAE

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Three years ago, in the course of studies of the development of the codling moth (Carpocapsa pomonella (L.)) it was necessary to observe the exact time of pupation of larvae without disturbing them and to be able to segregate individual pupae, unharmed, when external inspection showed them to be in the desired stage. Since pupae of the same age do not always reach a certain stage of development at the same time, the specimens were examined at frequent intervals so that some could be separated for further study under different conditions or for fixation and sectioning. Methods similar to that previously devised by Van Leeuwen[1] and those subsequently described by Cecil[2] and Fife[3] were tried, but were not sufficiently flexible for the experiments in question. The following is a description of the apparatus eventually developed for use in these experiments.

Strips of thin celluloid (about 0.75 millimeter thick) of the desired length were cut with a paper cutter to a width of one-half inch. A strip 12 or 14 inches long was found to be convenient. The strip of celluloid was coated liberally on one side with acetone or cellosolve until the surface was strongly adhesive, but not so that the entire strip was softened. Soda-water "straws"

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[1] Siegler, E. H., and Plank, H. K. Life history of the codling moth in the Grand Valley of Colorado. U. S. Dept. Agr. Bull. 932, 119 pp. September 1921.

[2] Cecil, Rodney. A cocooning rack. Bur. Ent. and Pl. Quar., ET-94 (multigraphed). March 1937.

[3] Fife, L. Courtney. A laboratory method for the study of insects in their cocoons. Bur. Ent. and Pl. Quar. ET-155 (multigraphed). February 1940.

made of colorless cellophane were laid side by side along the strip with their ends flush with one edge of the celluloid. The straws were pressed down firmly and evenly into the rapidly drying celluloid and became cemented to it as soon as the acetone had evaporated. The straws were then cut by running a pair of shears along the edge of the celluloid. The result was a flexible and transparent strip of individual cocooning units of exactly the right size. The strip could be bent or rolled and placed in a round, glass battery jar so that the celluloid backing fitted closely around the inside surface of the jar, with each cocooning unit visible; or small strips of a few units each could be cut off and stacked in any manner that appeared to be adapted to the work involved. Whatever method of arranging the units in a container was used, the caterpillars were placed with the strips and allowed to choose their own units for spinning. For observing the exact time and different stages of pupation, the method of curving the strips to fit against the inside of a battery jar was usually used (fig. 1). The pupa could be viewed from all angles, and, by rapid inspection, those of a certain developmental stage could be noted. Then, if desired, these could be segregated by carefully detaching the individual cocooning units from the celluloid. The pupa itself could be removed from its cocoon without injury by carefully slitting the cellophane straw with fine scissors.

If a large number of units are desired, they may be made more rapidly by using a sheet of celluloid wide enough to accommodate the entire length of the straws. When the celluloid sheet and the straws have become cemented and are dry, a paper cutter may be used to cut strips of the required widths.

Figure 1.--Four strips of cocooning units fitted in a battery jar. Most of the larvae shown in the cocooning units have finished spinning. (Photograph by L. P. Flory, Boyce Thompson Institute.)

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